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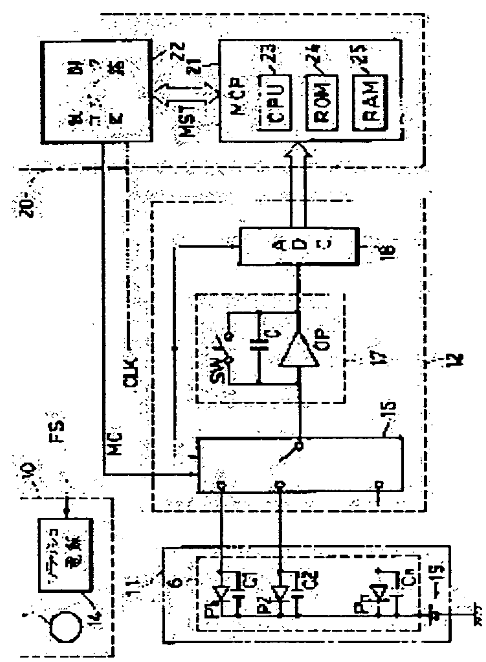
(54) METHOD AND DEVICE FOR MEASURING QUANTITY OF LIGHT



(57)Abstract:

PURPOSE: To measure quantity of light accurately by using a flashing light source and an electric charge accumulation type photoelectric converting element to eliminate influence of noise of stray light and dark current or the like.

CONSTITUTION: A control logic circuit 22 outputs three measuring signal MC and one light emitting signal FS at a constant period in response to the measurement starting signal MST. A multiplexer 16 takes out electric charge quantity of photo-diodes P1-Pn serially per measuring signal, and groups of the measured data, which are digitized by a chare amplifier 17 and an A/D converter 18, are stored in an RAM 25. Electric charge quantity before the first time measuring signal MS is cleared when the first time measuring signal MC is output, and a CPU 23 performs subtraction to subtract only a quantity of noise of the auxiliary measurement data, which is measured on the basis of the second time measuring signal MC and is stored in the RAM 25, from the main measurement data measured on the basis of the third measuring signal MC, which is emitted by a flashing light source 1 immediately before, to obtain the accurate data groups of quantity of light.

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CLAIMS

[Claim(s)]
[Claim 1] The quantity of light to which the sample was irradiated according to the flash plate light source, and the exposure light penetrated reflection, dispersion, or said sample by said sample In the actinometry approach which receives by the optoelectric transducer of the are recording mold which carries out proportionality conversion and accumulates the light-receiving quantity of light in a charge, and is measured Take out and measure the amount of charges accumulated after drawing of the last amount of charges, and activation of the measurement cycle which is the same period and repeats the actuation which memorizes the measurement data is faced. The front stirrup of the main measurement cycle which makes said flash plate light source emit light before drawing of said amount of charges approaches behind. The actinometry approach characterized by using as said amount data of measuring beams the difference data which subtracted and obtained the submeasurement data memorized by the submeasurement cycle from the main measurement data which performed the submeasurement cycle which does not make said flash plate light source emit light, and was memorized by the main measurement cycle before drawing of said amount of charges.
[Claim 2] It has the flash plate light source which irradiates a sample, and the optoelectric transducer of the are recording mold which carries out proportionality conversion and accumulates the light-receiving quantity of light in a charge. In the actinometry equipment with which the exposure light of said flash plate light source receives light by said optoelectric transducer, and measures the quantity of light which penetrated reflection, dispersion, or said sample by said sample The flash plate light source which makes said flash plate light source emit light according to a flashing caution signal, A measurement means to take out and measure the amount of charges accumulated in said optoelectric transducer after drawing of the amount of charges by the last measurement signal according to a measurement signal, While outputting said measurement signal with a data storage means to memorize the measurement data measured by the measurement means, and a predetermined period A timing means to output said flashing caution signal just before any one measurement signal of at least two of measurement signals of it, Actinometry equipment characterized by establishing an operation means to subtract the submeasurement data based on other measurement signals, and to obtain the amount data of measuring beams from the main measurement data based on the measurement signal immediately after luminescence of the flash plate light source by said flashing caution signal memorized by said data storage means, respectively.
[Claim 3] It has the flash plate light source which irradiates a sample, and the photo-electric-conversion elements which consist of an optoelectric transducer of two or more are recording molds which carry out proportionality conversion and accumulate the light-receiving quantity of light in a charge. In the actinometry equipment with which the exposure light of said flash plate light source receives light by said photo-electric-conversion elements, and measures the quantity of light which penetrated reflection, dispersion, or said sample by said sample The flash plate light source which makes said flash plate light source emit light according to a flashing caution signal, A measurement means to take out serially the amount of charges accumulated in said photo-electric-conversion elements, respectively after drawing of the amount of charges by

the last measurement signal, and to measure it according to a measurement signal, While outputting said measurement signal with a data storage means to memorize the measurement data group measured by the measurement means, respectively, and a predetermined period A timing means to output said flashing caution signal just before any one measurement signal of at least two of measurement signals of it, From the main measurement data group by the measurement signal immediately after luminescence of the flash plate light source by said flashing caution signal memorized by said data storage means, respectively The submeasurement data group by other measurement signals is each actinometry equipment characterized by establishing an operation means to subtract the measurement data based on the same optoelectric transducer, and to obtain the amount data constellation of measuring beams.
[Claim 4] While said timing means outputs at least three measurement signals which continue with a predetermined period in actinometry equipment according to claim 2 or 3 according to a measurement start signal A flashing caution signal is outputted just before the 3rd measurement signal. Said operation means The measurement data or the measurement data group by the 1st measurement signal which said timing means outputs, respectively is excepted from the candidate for an operation. Actinometry equipment characterized by processing, respectively what depends what depended on the 2nd measurement signal on submeasurement data or a submeasurement data group, and the 3rd measurement signal as the main measurement data or a main measurement data group.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the actinometry approach which measures the exact quantity of light except for the effect of the stray light, the dark current, etc. especially, and its equipment about the actinometry approach that the exposure light of the flash plate light source receives light by the are recording mold optoelectric transducer, and measures the quantity of light which penetrated reflection, dispersion, or a sample by the sample, and its equipment.
[0002]
[Description of the Prior Art] The actinometry approach which receives light by the optoelectric transducer (henceforth a "sensor"), and measures the quantity of light to which the sample was irradiated according to the light source and the exposure light penetrated reflection, dispersion, or a sample by the sample, or the actinometry equipment by the actinometry approach The reflectometer according mainly to reflection, a concentration meter, the penetrometer according mainly to transparency, a concentration meter, a turbidity meter, It is widely applied to equipments, such as suspended matter detection equipment the glossmeter by reflection and dispersion, and in the gas according mainly to dispersion, or a liquid or a spectroreflectometer which makes the spectral characteristic a problem, a spectral transmittance meter, and a colorimeter.
[0003] In comparatively easy equipment, the incandescent lamp was made into the light source, and although sensors, such as volatile Se photoelectric cell using photoelectromotive force or a photoconductivity, Si diode, and CdS photoconductor, were used, there was a problem that the temperature characteristic of sensibility (rate of photo electric conversion) could not be unstable, or effect of noise components, such as the instability of the light sources, such as a quantity of light ripple by aging or AC power supply of the quantity of light of an incandescent lamp, and the dark current, the stray light of an extraneous light, etc. could not be disregarded.
[0004] Since the effect of the dark current will decrease in proportion to a measurement cycle if the quantity of light uses the far large flash plate light source at the moment compared with other light sources, light is received by the sensor of an are recording mold and the storage time, i.e., a measurement cycle, is short-****(ed), and an extraneous light also falls relatively and sharply, the cure against the stray lights, such as electric shielding, becomes easy, and the precision of equipment also improves.
[0005] therefore, a measurement means to take out and measure the amount of charges in the latter part of a sensor and the need -- that -- the actinometry equipment which established a data storage means to memorize the measurement data of ****, and the actinometry equipment which formed the measurement means in the latter part of each sensor, respectively if there were two or more sensors were used widely.
[0006]
[Problem(s) to be Solved by the Invention] however, the spectroreflectometer and spectral transmittance meter with which the spectral characteristic poses a problem for measurement of the scattered light, or a high-concentration sample when there are little reflected light and

transmitted light — like — a spectrum — in order for the quantity of light itself which should be measured to fall, the effect of the dark current or the stray light increases again, and it becomes impossible to disregard relatively what lets equipment and a band pass filter pass

[0007] Especially in the case of a colorimeter, since the obtained spectral characteristic data are calculated and a result is searched for, still highly precise spectral characteristic data are needed. for example, — although the amount of incident light seldom falls since a sensor (optoelectric transducer) can be managed with three pieces, if it is the colorimeter of an easy tristimulus-value method — a spectrum — each band is subdivided with 20nm or 10nm as it is the colorimeter of a method — it is alike, and it follows, a sensor increases with 16 pieces or 32 pieces, an abbreviation inverse proportion is carried out at it, and the amount of incident light decreases.

[0008] moreover — although, as for the parallel measurement method which established the measurement means for every sensor when the amount of charges accumulated in the sensor was taken out and measured, a sensor seldom becomes a problem to one piece or about at most three pieces — a spectrum — when the number of sensors increased like the colorimeter of a method, cost increased, and there was also a trouble that a miniaturization became difficult.

[0009] This invention is made in view of the above-mentioned point, and it aims at offering the actinometry approach which measures the exact quantity of light, and its equipment except for the effect of the stray light, the dark current, etc.

[0010]

[Means for Solving the Problem] In order that this invention may attain the above-mentioned purpose, the 1st invention In the actinometry approach which receives the light-receiving quantity of light by the optoelectric transducer of the are recording mold which carries out proportionality conversion, and which is accumulated in a charge, and measures the quantity of light to which the sample was irradiated according to the flash plate light source, and the exposure light penetrated reflection, dispersion, or a sample by the sample Take out and measure the amount of charges accumulated after drawing of the last amount of charges, and activation of the measurement cycle which is the same period and repeats the actuation which memorizes the measurement data is faced. The front stirrup of the main measurement cycle which makes the flash plate light source emit light before drawing of the amount of charges approaches behind. The submeasurement cycle which does not make the flash plate light source emit light before drawing of the amount of charges is performed, and let the difference data which subtracted and obtained the submeasurement data memorized by the submeasurement cycle from the main measurement data memorized by the main measurement cycle be the amount data of measuring beams.

[0011] The 2nd invention is equipped with the flash plate light source which irradiates a sample, and the optoelectric transducer of the are recording mold which carries out proportionality conversion and accumulates the light-receiving quantity of light in a charge. In the actinometry equipment with which the exposure light of the flash plate light source receives light by the optoelectric transducer, and measures the quantity of light which penetrated reflection, dispersion, or a sample by the sample A measurement means to take out and measure the flash plate light source which makes the flash plate light source emit light according to a flashing caution signal, and the amount of charges accumulated in the optoelectric transducer according to the measurement signal after drawing of the amount of charges by the last measurement signal, A data storage means to memorize the measurement data measured by the measurement means, A timing means to output a flashing caution signal just before any one measurement signal of at least two of measurement signals of it while outputting a measurement signal with a predetermined period, An operation means to subtract the submeasurement data based on other measurement signals, and to obtain the amount data of measuring beams from the main measurement data based on the measurement signal immediately after luminescence of the flash plate light source by the flashing caution signal memorized by the data storage means, respectively is established.

[0012] The 3rd invention is equipped with the flash plate light source which irradiates a sample, and the photo-electric-conversion elements which consist of an optoelectric transducer of the

are recording mold with which proportionality conversion is carried out and plurality accumulates the light-receiving quantity of light in a charge. In the actinometry equipment with which the exposure light of the flash plate light source receives light by the photo-electric-conversion elements, and measures the quantity of light which penetrated reflection, dispersion, or a sample by the sample A measurement means to take out serially the flash plate light source which makes the flash plate light source emit light according to a flashing caution signal, and the amount of charges accumulated in the photo-electric-conversion elements according to the measurement signal, respectively after drawing of the amount of charges by the last measurement signal, and to measure it, A data storage means to memorize the measurement data group measured by the measurement means, respectively, A timing means to output a flashing caution signal just before any one measurement signal of at least two of measurement signals of it while outputting a measurement signal with a predetermined period, From the main measurement data group by the measurement signal immediately after luminescence of the flash plate light source by the flashing caution signal memorized by the data storage means, respectively An operation means to subtract the amount data of measuring beams of the submeasurement data group by other measurement signals according to the same optoelectric transducer respectively, and to obtain the amount data constellation of measuring beams is established.

[0013] In the 2nd or 3rd invention, a timing means outputs a flashing caution signal just before the 3rd measurement signal while outputting at least three measurement signals which continue with a predetermined period according to a measurement signal. The measurement data or the measurement data group by the 1st measurement signal to which a timing means outputs an operation means, respectively is excepted from the candidate for an operation. It is good to process, respectively what depends what is depended on the 2nd measurement signal on submeasurement data or a submeasurement data group, and the 3rd measurement signal as the main measurement data or a main measurement data group.

[0014]

[Function] According to the actinometry approach by the 1st invention, the main measurement data based on the main measurement cycle after making the flash plate light source emit light consists of the amount of charges proportional to light income, and the amount of charges for a noise by the stray light, the dark current, etc. Since the submeasurement data based on the submeasurement cycle which consists only of the amount of charges for the noise which does not make the flash plate light source emit light is subtracted from the main measurement data, the amount data of measuring beams proportional to the light-receiving quantity of light which is not influenced by the noise are obtained.

[0015] The actinometry equipment by the 2nd invention takes out and measures the amount of charges by which the measurement means was accumulated in the optoelectric transducer according to the measurement signal which a timing means outputs with a predetermined period, and a data storage means memorizes the measurement data. A flash plate power source makes the flash plate light source emit light according to the flashing caution signal which a timing means similarly outputs, and from the main measurement data based on the measurement signal immediately after luminescence which the data storage means memorized, respectively, an operation means subtracts the submeasurement data based on the measurement signal to which other flash plate light sources do not emit light, and outputs the amount data of measuring beams which are not influenced by the noise.

[0016] The actinometry equipment by the 3rd invention is taken out serially, and measures the amount of charges accumulated in the photo-electric-conversion elements which a measurement means becomes from two or more optoelectric transducers according to the measurement signal which a timing means outputs similarly, respectively, and a data storage means memorizes those measurement data groups, respectively. A flash plate power source makes the flash plate light source emit light according to the flashing caution signal which a timing means similarly outputs, and from the main measurement data group by the measurement signal immediately after luminescence which the data storage means memorized, respectively, an operation means subtracts the measurement data based on the same optoelectric transducer of

the submeasurement data group by the measurement signal to which other flash plate light sources do not emit light, respectively, and outputs the amount data constellation of measuring beams which is not influenced by the noise.
[0017] In the 2nd and 3rd invention, by at least three continuous measurement signals which a timing means outputs according to a measurement start signal The inside of the measurement data (or this group) which the measurement means and the data storage means measured and was memorized, If an operation means subtracts the submeasurement data (group) based on the 2nd measurement signal from the main measurement data (group) based on the 3rd measurement signal immediately after flash plate light source luminescence, the amount data of measuring beams (group) will be obtained for a short time. Here, the 1st measurement signal is a signal for clearing the amount of charges accumulated in the optoelectric transducer (group) before it, and the measurement data (group) based on it is disregarded.
[0018]
[Example] Hereafter, one example of this invention is concretely explained based on a drawing. Drawing 2 is the outline block diagram showing an example of the optical system of the spectral transmittance meter which is one example of this invention.
[0019] For example, the charge charged by the capacitor will discharge and the flash plate light source 1 which consists of the cold cathode xenon discharge tube will emit a powerful flash plate light to dozens thru/or a short time for about hundreds of microseconds, if it connects with the capacitor and trigger circuit which are not illustrated, respectively and which were comparatively charged by the high voltage and a high-pressure trigger signal is impressed from a trigger circuit.

[0020] the light-receiving side top of the photodiode array (photo-electric-conversion elements) 6 which consists of a photodiode P1 which are two or more optoelectric transducers, and P2 -- Pn with the image formation lens 5 after the spectrum of the parallel transmitted light which the synchrotron orbital radiation was changed into parallel light by the collimator lens 2, irradiated the sample 3, and penetrated the sample 3 is carried out by the diffraction grating 4 -- a spectrum, i.e., a spectrum, -- a quantity of light distribution image is formed.
[0021] the spectrum -- quantity of light distribution -- each of the photodiode array 6 -- a spectrum -- although measured by the measuring circuit which it is changed into a current or a charge by each photodiodes P1-Pn corresponding to a region, and the latter part does not illustrate, generally, the spectral sensitivity of a photodiode is not necessarily uniform, and in order to show the characteristic spectral sensitivity characteristic which is different with the quality of the material, for example, Se, germanium, Si, etc., which constitutes a photodiode, respectively, if it remains as it is, a right spectral transmittance property is not acquired.
[0022] Therefore, if it is a photographic filter before measuring a sample, transparent and colorless quality of the material, i.e., sample, which an optical property approximates to a sample, and is the gelatin film, optical glass, and a liquid sample, a right spectral transmittance property will be acquired by taking a ratio with the measurement data measured about standard substances, such as the solvent or a liquid of equivalence, or a standard sample with a clear spectral transmittance property.
[0023] however, the stray light A mixed since electric shielding of outdoor daylight is imperfect, for example, the stray light before sample transparency, and a spectrum -- the front stray light B and a spectrum -- although the next stray light C has the large instant quantity of light of the flash plate light source, since the quantity of light falls with sample transparency and a spectrum, respectively, the effect of the stray light becomes large, so that it becomes the latter. moreover, the dark current of a photodiode -- a temperature rise -- a logarithm -- since it increases-like, it is as having already stated that the error by mixing of these noise components is not avoided.
[0024] Drawing 1 is the circuit diagram showing the example of 1 configuration of the electric system of the example (spectral transmittance meter) shown in drawing 2 , and drawing 3 is the wave form chart showing an example of each part signal of the circuit. The electric system shown in drawing 1 divides roughly, and consists of the light source section 10, a light sensing portion 11, a test section 12 that is a measurement means, and a control section 20.
[0025] The light source section 10 emits the flash plate light of the predetermined quantity of

light determined with the capacity and its charge electrical potential difference of the power capacitor which will not be illustrated within the flash plate power source 14 if it consists of the flash plate light source 1 and a flash plate power source 14 which outputs a trigger signal according to a flashing caution signal FS while supplying luminescence power to the flash plate light source 1 and a flashing caution signal FS inputs from the flash plate light source 1.

[0026] A light sensing portion 11 consists of a photodiode array 6 which is the photo-electric-conversion elements, and a cell 15 which impresses DC electrical potential difference of a reverse bias to each photodiodes P1-Pn which constitute it. The capacitors C1-Cn shown in each photodiodes P1-Pn at juxtaposition, respectively are junction capacitances, and although the capacity is very small, it accumulates the charge generated in proportion to the light-receiving quantity of light, it emits a charge at the time of measurement, and is cleared at it.

[0027] The test section 12 which is a measurement means consists of a multiplexer (analog) 16, a charge amp 17, and A/D converter 18. An address clearance being carried out according to the input of a measurement signal MC, and counting up the address according to Clock CLK, a multiplexer 16 takes out the charge accumulated in the junction capacitance Ck of the photodiode Pk corresponding to the address k, and outputs it to the charge amp 17 of the next step. If the address reaches the maximum, it will not count up, even if Clock CLK inputs.

[0028] A charge amp (integrating amplifier) 17 is the sample hold circuit which consisted of parallel circuits of an operational amplifier OP, and Capacitor C and Switch SW which were inserted in the feedback circuit theoretically, and outputs the charge electrical potential difference Vs of the capacitor C proportional to the amount of charges serially outputted from a multiplexer 16 synchronizing with Clock CLK to A/D converter 18 of the next step.

[0029] For example, after only the time amount which needs A/D converter 18 for a convert holds an electrical potential difference Vs synchronizing with Clock CLK, the switch SW which consists of a solid state switch short-circuits momentarily, and makes the both ends of Capacitor C discharge, and measurement of the amount of charges inputted into a degree is equipped with it. It is not necessary to explain A/D converter 18 anew, it changes the analog output electrical potential difference Vs of a charge amp 17 into 8-16-bit digital measurement data, and outputs it to the microcomputer (henceforth "MCP") 21 of the next step.

[0030] The control section 20 consists of MCP21 and a control logical circuit 22. MCP21 consists of CPU23, ROM24, and RAM25 grade, outputs the measurement start signal MST to the control logical circuit 22 according to directions of an operator, and starts measurement while CPU23 controls the whole equipment based on the program beforehand stored in ROM24.

[0031] Moreover, after making RAM25 which is a data storage means memorize once the measurement data which a test section 12 (A/D converter 18) outputs, CPU23 which is an operation means reads the main measurement data and submeasurement data for every photodiodes P1-Pn, by subtracting submeasurement data from the main measurement data, calculates the amount data of measuring beams, and stores the obtained amount data of measuring beams in RAM25.

[0032] The control logical circuit 22 which is a timing means counts the clock CLK, forms a measurement signal MC and a flashing caution signal FS, and outputs them to a multiplexer 16 and the flash plate power source 14, respectively while it outputs the clock CLK which the oscillator to build in, and which is not illustrated outputs or is inputted from CPU23 of MCP21 to Switch SW and A/D converter 18 of a multiplexer 16 or a charge amp 17 which constitute a test section 12.

[0033] That is, as shown in drawing 3 , the control logical circuit 22 counts Clock CLK, and forms the timing signal of a period T. Counted value [beforehand / (n+f+alpha+beta)] is set up so that only the clock (alpha+beta) for allowances may become long rather than the sum of the time amount (n clock) required for this period T to measure serially the amount of charges of n photodiodes P1-Pn, and the time amount (f clock) which luminescence of the flash plate light source 1 takes.

[0034] Moreover, after a clock, i.e., serial measurement, is completed from a timing signal (n+alpha), alpha clock delay ****** of the flashing caution signal FS is carried out, and counted value (n+alpha) to which luminescence of the flash plate light source 1 has ended only beta clock

before is beforehand set up rather than the following timing signal is moreover outputted.
[0035] Therefore, the control logical circuit 22 outputs clock delay ********** FS to the flash plate power source 14 from the 2nd measurement signal MC 2 (n+alpha), and makes the flash plate light source 1 emit light, if the measurement start signal MST inputs from MCP21 while outputting it to a multiplexer 16 by making three timing signals following it into measurement signals MC1-MC3.
[0036] The measurement cycle by the measurement signal MC 1 is a clear cycle which clears the charge accumulated in each photodiodes P1-Pn of the photodiode array 6 before it, and since it is the purpose to make each amount of charges into zero, and to start the charge storage for submeasurement, even if it memorizes whether the digital measurement data group which A/D converter 18 outputs is memorized to RAM25, it excepts from the candidate for an operation.
[0037] Since the flash plate light source 1 is not emitting light before that, the measurement cycle by the measurement signal MC 2 is a submeasurement cycle, and the output of A/D converter 18 is memorized by RAM25 as submeasurement data which is the amount of charges for a noise by the stray light and the dark current. After submeasurement of each photodiode is completed, a flashing caution signal FS is outputted and the flash plate light source 1 emits light. The measurement cycle by the measurement signal MC 3 immediately after the flash plate light source 1 finishes emitting light is the main measurement cycle, and the output of A/D converter 18 is memorized by RAM25 as main measurement data which is the sum of the light-receiving quantity of light and the amount of charges for a noise.
[0038] If it sees about the photodiode Pk of the k-th piece (1 <=k<=n), since the amount of charges for the noise by which k clock ****** clearance was carried out from the measurement signal MC 1, and k clock delay ****** was carried out from the measurement signal MC 2 will become submeasurement data, the storage time is equal to the period T of a measurement signal. The same is said of the storage time of the main measurement data, and all the charge storage times for submeasurement of Photodiodes P1-Pn and the main measurement are equal to the fixed period T.
[0039] Therefore, since the charge storage time of all photodiodes is fixed, even if the amount of incidence of the stray light differs from the charge yield per unit time amount by the dark current for every photodiode, the amount data of measuring beams which are not influenced of [for a noise] are obtained by subtracting submeasurement data from the main measurement data of the photodiode. Moreover, since the main measurement cycle and the submeasurement cycle are close, even if the ambient temperature which influences greatly is changing to the extraneous light and the dark current which caused the stray light, if the change is not remarkably quick, they are not influenced.
[0040] Although this example explained the case where three measurement signals required for each cycle were used in order of a clearance, submeasurement, and the main measurement, even if it exchanges the order of the main measurement cycle and a submeasurement cycle, that effectiveness does not change. Moreover, in 1 time of a clear cycle, if long duration are recording of the amount of charges is carried out by the saturation state before measurement depending on the quality of the material of a photodiode, since there is a possibility that a charge may not become zero, 2 - 3 times, or after repeating continuously, you may go a clear cycle into the Lord and the measurement cycle of **.
[0041] Moreover, as long as it always outputted the measurement signal MC and has cleared the amount of charges of a photodiode instead of outputting a measurement signal MC after the measurement start signal MST inputs, since light is already intercepted in practice just before measurement initiation in many cases, the clear cycle after a measurement start signal MST input may be omitted, and you may go into the measurement cycle of the main ** immediately. In this case, what is necessary is to perform a submeasurement cycle by the measurement signal MC 1, to perform a measurement cycle by the measurement signal MC 2, for example, and just to output a flashing caution signal FS after a clock from a measurement signal MC 1 (n+alpha).
[0042] Although this example formed the multiplexer 16 which takes out the amount of charges serially to a test section 12, using the photodiode array which builds a shift register in the

photodiode array 6 of a light sensing portion 11, and is serially outputted to it, it may omit the multiplexer 16 of a test section 12, and a linear sensor like CCD may be used for it.
[0043] the spectrum which each photodiode shares with a spectral transmittance meter as shown in drawing 2 — since there is an inclination which the amount of [by a period T being prolonged against the amount of incident light falling] noise increases so that a region (bandwidth) becomes narrow and n becomes large, the effectiveness that the amount data of measuring beams the amount of noise is not by this invention are obtained is large.
[0044] Although the example explained above was the case where the photodiode array 6 was used The reflectometer and concentration meter which get the data converted into monochrome using the sensor which has the property which is in agreement with monochrome or visibility, Or even when making the spectral characteristic into a problem, it cannot be overemphasized in the equipment using one sensor which exchanges a band pass filter and a RGB filter and is measured each time (for example, a multiplexer 16 becomes unnecessary) that this invention is applicable.
[0045]
[Effect of the Invention] As explained above, according to this invention, the exact quantity of light can be measured except for the effect of the stray light, the dark current, etc.

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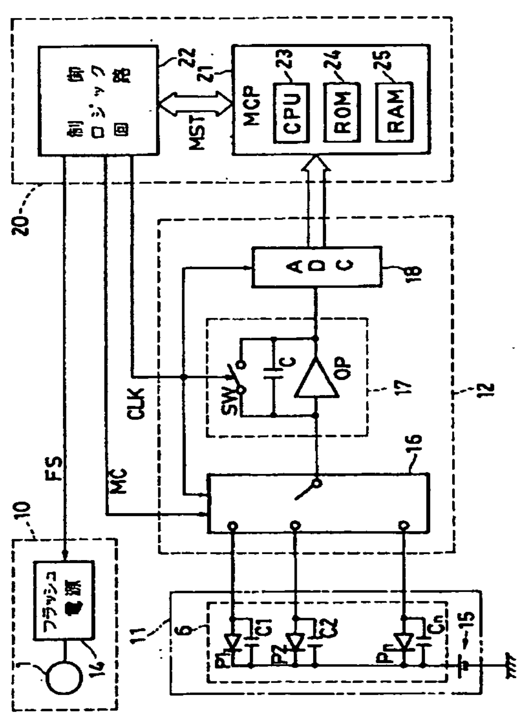
(54)【発明の名称】光量測定方法及びその装置

(57)【要約】

【目的】　フラッシュ光源と電荷蓄積型の光電変換素子とを用いて、迷光や暗電流等のノイズ分の影響を除いた正確な光量を測定する。

【構成】　測定開始信号ＭＳＴに応じて制御ロジック回路２２は一定の周期で３個の測定信号ＭＣと１個の発光信号ＦＳを出力する。各測定信号毎にマルチプレクサ１６はフォトダイオードＰ１～Ｐｎの電荷量をシリアルに取出し、チャージアンプ１７，Ａ／Ｄコンバータ１８によりデジタル化した測定データ群はＲＡＭ２５に記憶される。１回目の測定信号ＭＣでそれ以前の電荷量はクリアされ、ＲＡＭ２５に記憶された２回目の測定信号ＭＣによる副測定データ群と、直前にフラッシュ光源１が発光した３回目の測定信号ＭＣによる主測定データ群とは、ＣＰＵ２３により、各フォトダイオード毎に主測定データからノイズ分のみの副測定データを減算されて、正確な光量データ群が得られる。



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【特許請求の範囲】

【請求項１】　フラッシュ光源により試料を照射し、その照射光が前記試料によって反射又は散乱あるいは前記試料を透過した光量を、受光光量を電荷に比例変換して蓄積する蓄積型の光電変換素子により受光して測定する光量測定方法において、

前回の電荷量の取出し以降に蓄積された電荷量を取出して測定し、その測定データを記憶する動作を同一周期で繰返す測定サイクルの実行に際し、前記電荷量の取出し前に前記フラッシュ光源を発光させる主測定サイクルの前又は後に近接して、前記電荷量の取出し前に前記フラッシュ光源を発光させない副測定サイクルを実行し、その主測定サイクルで記憶した主測定データから副測定サイクルで記憶した副測定データを減算して得た差データを前記測定光量データとすることを特徴とする光量測定方法。

【請求項２】　試料を照射するフラッシュ光源と、受光光量を電荷に比例変換して蓄積する蓄積型の光電変換素子とを備え、前記フラッシュ光源の照射光が前記試料によって反射又は散乱あるいは前記試料を透過した光量を前記光電変換素子により受光して測定する光量測定装置において、

発光信号に応じて前記フラッシュ光源を発光させるフラッシュ光源と、

測定信号に応じて、前回の測定信号による電荷量の取出し以降に前記光電変換素子に蓄積された電荷量を取出して測定する測定手段と、

その測定手段により測定された測定データを記憶するデータ記憶手段と、

所定の周期で前記測定信号を出力すると共に、そのうちの少くとも２個の測定信号のいずれか１個の測定信号の直前に前記発光信号を出力するタイミング手段と、

前記データ記憶手段にそれぞれ記憶される前記発光信号によるフラッシュ光源の発光直後の測定信号による主測定データから、他の測定信号による副測定データを減算して測定光量データを得る演算手段とを設けたことを特徴とする光量測定装置。

【請求項３】　試料を照射するフラッシュ光源と、受光光量を電荷に比例変換して蓄積する複数の蓄積型の光電変換素子からなる光電変換素子群とを備え、前記フラッシュ光源の照射光が前記試料によって反射又は散乱あるいは前記試料を透過した光量を前記光電変換素子群により受光して測定する光量測定装置において、

発光信号に応じて前記フラッシュ光源を発光させるフラッシュ光源と、

測定信号に応じて、前回の測定信号による電荷量の取出し以降に前記光電変換素子群にそれぞれ蓄積された電荷量をシリアルに取出して測定する測定手段と、

その測定手段により測定された測定データ群をそれぞれ記憶するデータ記憶手段と、

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所定の周期で前記測定信号を出力すると共に、そのうちの少くとも２個の測定信号のいずれか１個の測定信号の直前に前記発光信号を出力するタイミング手段と、

前記データ記憶手段にそれぞれ記憶される前記発光信号によるフラッシュ光源の発光直後の測定信号による主測定データ群から、他の測定信号による副測定データ群のそれぞれ同一光電変換素子による測定データを減算して測定光量データ群を得る演算手段とを設けたことを特徴とする光量測定装置。

【請求項４】　請求項２又は３記載の光量測定装置において、

測定開始信号に応じて、前記タイミング手段は所定の周期で連続する少くとも３個の測定信号を出力すると共に、その第３番目の測定信号の直前に発光信号を出力し、

前記演算手段は、前記タイミング手段がそれぞれ出力する第１番目の測定信号による測定データ又は測定データ群は演算対象から除外し、第２番目の測定信号によるものを副測定データ又は副測定データ群、第３番目の測定信号によるものを主測定データまたは主測定データ群としてそれぞれ処理するようにしたことを特徴とする光量測定装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、フラッシュ光源の照射光が試料によって反射又は散乱あるいは試料を透過した光量を蓄積型光電変換素子により受光して測定する光量測定方法及びその装置に関し、特に迷光や暗電流等の影響を除いて正確な光量を測定する光量測定方法及びその装置に関する。

【０００２】

【従来の技術】光源により試料を照射し、その照射光が試料によって反射又は散乱あるいは試料を透過した光量を光電変換素子（以下「センサ」ともいう）により受光して測定する光量測定方法又はその光量測定方法による光量測定装置は、主として反射による反射率計，濃度計、主として透過による透過率計，濃度計，濁度計、反射と散乱による光沢度計、主として散乱による気体や液体中の浮遊物検出装置、あるいは分光特性を問題とする分光反射率計，分光透過率計，色彩計等の装置に広く応用されている。

【０００３】比較的簡単な装置においては、白熱ランプを光源とし、光起電力や光導電性を利用した非蓄積型のＳｅ光電池，Ｓｉダイオード，ＣｄＳ光導電体等のセンサが使用されているが、感度（光電変換率）の温度特性が不安定であったり、白熱ランプの光量の経時変化や交流電源による光量リプル等の光源の不安定性、暗電流や外部光の迷光等のノイズ成分の影響等が無視出来ないという問題があった。

【０００４】他の光源に比べて瞬間光量が遥かに大きい

フラッシュ光源を使用し、蓄積型のセンサにより受光してその蓄積時間即ち測定周期を短かくすれば、暗電流の影響は測定周期に比例して減少し、外部光も相対的に大幅に低下するから遮蔽等の迷光対策が簡単になり、装置の精度も向上する。

【０００５】したがって、センサの後段にその電荷量を取出して測定する測定手段と、必要あればその測定データを記憶するデータ記憶手段とを設けた光量測定装置、もしセンサが複数個あれば、各センサの後段にそれぞれ測定手段を設けた光量測定装置が広く使用されていた。

【０００６】

【発明が解決しようとする課題】しかしながら、散乱光の測定や高濃度の試料のため反射光や透過光が少ない場合、あるいは分光特性が問題となる分光反射率計，分光透過率計のように分光装置やバンドパスフィルタを通すものは、測定すべき光量自体が低下するため、相対的に暗電流や迷光の影響が再び増大して無視出来なくなる。

【０００７】特に色彩計の場合は、得られた分光特性データを演算して結果を求めるものであるから、さらに高精度な分光特性データを必要とする。例えば、簡単な３刺激値方式の色彩計ならばセンサ（光電変換素子）は３個で済むから、入射光量は余り低下しないが、分光方式の色彩計であると、各帯域を２０nmまたは１０nmと細分するに従ってセンサが１６個又は３２個と増加し、それに略反比例して入射光量が減少する。

【０００８】また、センサに蓄積した電荷量を取出して測定する場合に各センサ毎に測定手段を設けたパラレル測定方式は、センサが１個又はせいぜい３個程度までは余り問題にならないが、分光方式の色彩計のようにセンサの数が増えてくるとコストが増大し、小型化が困難になるという問題点もあった。

【０００９】この発明は上記の点に鑑みてなされたものであり、迷光や暗電流等の影響を除いて、正確な光量を測定する光量測定方法及びその装置を提供することを目的とする。

【００１０】

【課題を解決するための手段】この発明は上記の目的を達成するため、第１の発明は、フラッシュ光源により試料を照射し、その照射光が試料によって反射又は散乱あるいは試料を透過した光量を、受光光量を電荷に比例変換して蓄積する蓄積型の光電変換素子により受光して測定する光量測定方法において、前回の電荷量の取出し以降に蓄積された電荷量を取出して測定し、その測定データを記憶する動作を同一周期で繰返す測定サイクルの実行に際し、電荷量の取出し前にフラッシュ光源を発光させる主測定サイクルの前又は後に近接して、電荷量の取出し前にフラッシュ光源を発光させない副測定サイクルを実行し、その主測定サイクルで記憶した主測定データから副測定サイクルで記憶した副測定データを減算して得た差データを測定光量データとするものである。

【００１１】第２の発明は、試料を照射するフラッシュ光源と、受光光量を電荷に比例変換して蓄積する蓄積型の光電変換素子とを備え、フラッシュ光源の照射光が試料によって反射又は散乱あるいは試料を透過した光量を光電変換素子により受光して測定する光量測定装置において、発光信号に応じてフラッシュ光源を発光させるフラッシュ光源と、測定信号に応じて前回の測定信号による電荷量の取出し以降に光電変換素子に蓄積された電荷量を取出して測定する測定手段と、その測定手段により測定された測定データを記憶するデータ記憶手段と、所定の周期で測定信号を出力すると共にそのうちの少くとも２個の測定信号のいずれか１個の測定信号の直前に発光信号を出力するタイミング手段と、データ記憶手段にそれぞれ記憶される発光信号によるフラッシュ光源の発光直後の測定信号による主測定データから、他の測定信号による副測定データを減算して測定光量データを得る演算手段とを設けたものである。

【００１２】第３の発明は、試料を照射するフラッシュ光源と、受光光量を電荷に比例変換して複数の蓄積する蓄積型の光電変換素子からなる光電変換素子群とを備え、フラッシュ光源の照射光が試料によって反射又は散乱あるいは試料を透過した光量を光電変換素子群により受光して測定する光量測定装置において、発光信号に応じてフラッシュ光源を発光させるフラッシュ光源と、測定信号に応じて前回の測定信号による電荷量の取出し以降に光電変換素子群にそれぞれ蓄積された電荷量をシリアルに取出して測定する測定手段と、その測定手段により測定された測定データ群をそれぞれ記憶するデータ記憶手段と、所定の周期で測定信号を出力すると共にそのうちの少くとも２個の測定信号のいずれか１個の測定信号の直前に発光信号を出力するタイミング手段と、データ記憶手段にそれぞれ記憶される発光信号によるフラッシュ光源の発光直後の測定信号による主測定データ群から、他の測定信号による副測定データ群のそれぞれ同一光電変換素子による測定光量データを減算して測定光量データ群を得る演算手段とを設けたものである。

【００１３】第２又は第３の発明において、タイミング手段は測定信号に応じて所定の周期で連続する少くとも３個の測定信号を出力すると共にその第３番目の測定信号の直前に発光信号を出力し、演算手段はタイミング手段がそれぞれ出力する第１番目の測定信号による測定データ又は測定データ群は演算対象から除外し、第２番目の測定信号によるものを副測定データ又は副測定データ群、第３番目の測定信号によるものを主測定データまたは主測定データ群としてそれぞれ処理するようにするとよい。

【００１４】

【作用】第１の発明による光量測定方法によれば、フラッシュ光源を発光させた後の主測定サイクルによる主測定データは受光量に比例した電荷量と迷光，暗電流等に

よるノイズ分の電荷量とからなり、その主測定データからフラッシュ光源を発光させないノイズ分の電荷量のみからなる副測定サイクルによる副測定データを減算するから、ノイズに影響されない受光光量に比例した測定光量データが得られる。

【0015】第2の発明による光量測定装置は、タイミング手段が所定の周期で出力する測定信号に応じて測定手段が光電変換素子に蓄積された電荷量を取出して測定し、その測定データをデータ記憶手段が記憶する。同じくタイミング手段が出力する発光信号に応じてフラッシュ電源がフラッシュ光源を発光させ、演算手段はデータ記憶手段がそれぞれ記憶した発光直後の測定信号による主測定データから、他のフラッシュ光源が発光しない測定信号による副測定データを減算して、ノイズに影響されない測定光量データを出力する。

【0016】第3の発明による光量測定装置は、同様にタイミング手段が出力する測定信号に応じて測定手段が複数の光電変換素子からなる光電変換素子群にそれぞれ蓄積された電荷量をシリアルに取出して測定し、それらの測定データ群をデータ記憶手段がそれぞれ記憶する。同じくタイミング手段が出力する発光信号に応じてフラッシュ電源がフラッシュ光源を発光させ、演算手段はデータ記憶手段がそれぞれ記憶した発光直後の測定信号による主測定データ群から、他のフラッシュ光源が発光しない測定信号による副測定データ群のそれぞれ同一光電変換素子による測定データを減算して、ノイズに影響されない測定光量データ群を出力する。

【0017】第2及び第3の発明において、タイミング手段が測定開始信号に応じて出力する連続した少くとも3個の測定信号によって、測定手段とデータ記憶手段とが測定して記憶した測定データ（又は同群）のうち、演算手段がフラッシュ光源発光直後の第3番目の測定信号による主測定データ（群）から、第2番目の測定信号による副測定データ（群）を減算すれば短時間で測定光量データ（群）が得られる。ここで、第1番目の測定信号はそれ以前に光電変換素子（群）に蓄積されていた電荷量をクリアするための信号であり、それによる測定データ（群）は無視する。

【0018】

【実施例】以下、この発明の一実施例を図面に基づいて具体的に説明する。図2は、この発明の一実施例である分光透過率計の光学系の一例を示す概略構成図である。

【0019】例えば冷陰極クセノン放電管からなるフラッシュ光源1は、それぞれ図示しない比較的高電圧に充電されたコンデンサとトリガ回路とに接続され、トリガ回路から高圧トリガ信号が印加されると、コンデンサに充電されていた電荷が放電して、数十乃至数百μs程度の短時間に強力なフラッシュ光を放射する。

【0020】その放射光はコリメータレンズ2により平行光に変換されて試料3を照射し、試料3を透過した平行な透過光は回折格子4により分光された後、結像レンズ5によって複数の光電変換素子であるフォトダイオードP1，P2…Pnからなるフォトダイオードアレー（光電変換素子群）6の受光面上にスペクトル即ち分光光量分布像を形成する。

【0021】その分光光量分布は、フォトダイオードアレー6のそれぞれ分光域に対応する各フォトダイオードP1～Pnにより電流又は電荷に変換され、後段の図示しない測定回路により測定されるが、一般にフォトダイオードの分光感度は必ずしも均一ではなく、フォトダイオードを構成する材質例えばSe，Ge，Si等によりそれぞれ異なる特有の分光感度特性を示すため、そのままでは正しい分光透過率特性が得られない。

【0022】そのため、試料を測定する前に光学特性が試料に近似する無色透明な材質すなわち試料が例えば写真用フィルタであればゼラチン膜や光学ガラス、液体試料であればその溶媒又は等価の液体等の標準試料、あるいは分光透過率特性が明らかな規準試料について測定しておいた測定データとの比をとることにより、正しい分光透過率特性が得られる。

【0023】しかしながら、外光の遮蔽が不完全なために混入する迷光、例えば試料透過前の迷光A、分光前の迷光B、分光後の迷光Cは、フラッシュ光源の瞬時光量が大きいとはいえ、試料透過，分光によりそれぞれ光量が低下するため、後者になるほど迷光の影響が大きくなる。また、フォトダイオードの暗電流は温度上昇により対数的に増大するため、これらのノイズ成分の混入による誤差が避けられないことは、既に述べた通りである。

【0024】図1は図2に示した実施例（分光透過率計）の電気系の一構成例を示す回路図であり、図3はその回路の各部信号の一例を示す波形図である。図1に示した電気系は大別して、光源部10と、受光部11と、測定手段である測定部12と、制御部20とから構成されている。

【0025】光源部10は、フラッシュ光源1と、フラッシュ光源1に発光電力を供給すると共に、発光信号FSに応じてトリガ信号を出力するフラッシュ電源14とからなり、発光信号FSが入力するとフラッシュ電源14内の図示しないパワーコンデンサの容量とその充電電圧とにより決定される所定光量のフラッシュ光をフラッシュ光源1から放射する。

【0026】受光部11は、光電変換素子群であるフォトダイオードアレー6と、それを構成する各フォトダイオードP1～Pnに逆バイアスのDC電圧を印加する電池15とからなる。各フォトダイオードP1～Pnにそれぞれ並列に示したコンデンサC1～Cnは接合容量であり、その容量は微少であるが受光光量に比例して発生した電荷を蓄積し、測定時には電荷を放出してクリアされる。

【0027】測定手段である測定部12は、マルチプレ

クサ（アナログ）１６とチャージアンプ１７とＡ／Ｄコンバータ１８とから構成されている。マルチプレクサ１６は測定信号ＭＣの入力に応じてアドレスクリアされ、クロックＣＬＫに応じてアドレスをカウントアップしながらそのアドレスｋに対応するフォトダイオードＰｋの接合容量Ｃｋに蓄積された電荷を取出して次段のチャージアンプ１７に出力する。アドレスがその最大値に達すれば、クロックＣＬＫが入力してもカウントアップしない。

【００２８】チャージアンプ（積分増幅器）１７は、原理的にオペアンプＯＰとそのフィードバック回路に挿入されたコンデンサＣとスイッチＳＷとの並列回路とから構成されたサンプルホールド回路であり、マルチプレクサ１６からクロックＣＬＫに同期してシリアルに出力される電荷量に比例したコンデンサＣの充電電圧Ｖｓを次段のＡ／Ｄコンバータ１８に出力する。

【００２９】例えば半導体スイッチからなるスイッチＳＷは、クロックＣＬＫに同期してＡ／Ｄコンバータ１８がコンバートに必要な時間だけ電圧Ｖｓをホールドした後、コンデンサＣの両端を瞬間的にショートして放電させ、次に入力する電荷量の測定に備える。Ａ／Ｄコンバータ１８は、改めて説明するまでもなく、チャージアンプ１７のアナログ出力電圧Ｖｓを例えば８～１６ビットのデジタル測定データに変換し、次段のマイクロコンピュータ（以下「ＭＣＰ」という）２１に出力する。

【００３０】制御部２０はＭＣＰ２１と制御ロジック回路２２とから構成されている。ＭＣＰ２１は、ＣＰＵ２３，ＲＯＭ２４，ＲＡＭ２５等からなり、ＲＯＭ２４に予め格納されているプログラムに基づいてＣＰＵ２３が装置全体を制御すると共に、オペレータの指示に応じて測定開始信号ＭＳＴを制御ロジック回路２２に出力し、測定をスタートさせる。

【００３１】また、演算手段であるＣＰＵ２３は、測定部１２（のＡ／Ｄコンバータ１８）が出力する測定データをデータ記憶手段であるＲＡＭ２５に一度記憶させた後、各フォトダイオードＰ１～Ｐｎ毎にその主測定データと副測定データとを読出して、主測定データから副測定データを減算することにより測定光量データを計算し、得られた測定光量データをＲＡＭ２５に格納する。

【００３２】タイミング手段である制御ロジック回路２２は、内蔵する図示しない発振器が出力するかＭＣＰ２１のＣＰＵ２３から入力するクロックＣＬＫを、測定部１２を構成するマルチプレクサ１６やチャージアンプ１７のスイッチＳＷやＡ／Ｄコンバータ１８に出力すると共に、そのクロックＣＬＫをカウントして測定信号ＭＣと発光信号ＦＳを形成し、それぞれマルチプレクサ１６とフラッシュ電源１４とに出力する。

【００３３】すなわち、図３に示したように、制御ロジック回路２２はクロックＣＬＫをカウントして周期Ｔのタイミング信号を形成している。この周期Ｔは、ｎ個のフォトダイオードＰ１～Ｐｎの電荷量をシリアルに測定するに要する時間（ｎクロック）と、フラッシュ光源１の発光に要する時間（ｆクロック）との和よりも余裕分の（α＋β）クロックだけ長くなるように、予め（ｎ＋ｆ＋α＋β）のカウント値が設定されている。

【００３４】また、発光信号ＦＳはタイミング信号から（ｎ＋α）クロック即ちシリアルな測定が終了してからαクロック遅れて出力され、しかも次のタイミング信号が出力されるよりβクロックだけ前にフラッシュ光源１の発光が終了しているようなカウント値（ｎ＋α）が予め設定されている。

【００３５】したがって、ＭＣＰ２１から測定開始信号ＭＳＴが入力すると、制御ロジック回路２２はそれに続く３個のタイミング信号を測定信号ＭＣ１～ＭＣ３としてマルチプレクサ１６に出力すると共に、第２番目の測定信号ＭＣ２から（ｎ＋α）クロック遅れて発光信号ＦＳをフラッシュ電源１４に出力し、フラッシュ光源１を発光させる。

【００３６】測定信号ＭＣ１による測定サイクルは、それ以前にフォトダイオードアレー６の各フォトダイオードＰ１～Ｐｎに蓄積されていた電荷をクリアするクリアサイクルであり、各電荷量をゼロにして副測定のための電荷蓄積をスタートさせることが目的であるから、Ａ／Ｄコンバータ１８が出力するデジタルの測定データ群はＲＡＭ２５に記憶しないか、記憶しても演算対象からは除外する。

【００３７】測定信号ＭＣ２による測定サイクルは、その前にフラッシュ光源１が発光していないから副測定サイクルであり、Ａ／Ｄコンバータ１８の出力は迷光及び暗電流によるノイズ分の電荷量である副測定データとしてＲＡＭ２５に記憶される。各フォトダイオードの副測定が終了した後で、発光信号ＦＳが出力されフラッシュ光源１が発光する。フラッシュ光源１が発光し終った直後の測定信号ＭＣ３による測定サイクルは主測定サイクルであり、Ａ／Ｄコンバータ１８の出力は受光光量とノイズ分の電荷量の和である主測定データとしてＲＡＭ２５に記憶される。

【００３８】第ｋ個目（１≦ｋ≦ｎ）のフォトダイオードＰｋについて見ると、測定信号ＭＣ１からｋクロック遅れてクリアされ、測定信号ＭＣ２からｋクロック遅れて取出されたノイズ分の電荷量が副測定データになるから、その蓄積時間は測定信号の周期Ｔに等しい。主測定データの蓄積時間も同様であり、フォトダイオードＰ１～Ｐｎの副測定及び主測定のための電荷蓄積時間はすべて一定の周期Ｔに等しい。

【００３９】したがって、すべてのフォトダイオードの電荷蓄積時間は一定であるから、フォトダイオード毎に迷光の入射量及び暗電流による単位時間当りの電荷発生量が異なっていても、そのフォトダイオードの主測定データから副測定データを減算することにより、ノイズ分

の影響を受けない測定光量データが得られる。また、主測定サイクルと副測定サイクルとは近接しているから、迷光の原因である外部光や暗電流に大きく影響する周囲温度が変化していても、その変化が著しく速くなければ影響を受けない。

【００４０】この実施例では、クリア，副測定，主測定の順で各サイクルのために必要な３個の測定信号を用いた場合について説明したが、主測定サイクルと副測定サイクルの順を交換してもその効果は変らない。また、フォトダイオードの材質によっては、測定前に電荷量が飽和状態で長時間蓄積されていると、１回のクリアサイクルでは電荷がゼロにならない恐れがあるから、クリアサイクルを２～３回又は連続して繰返したのち主，副の測定サイクルに入ってもよい。

【００４１】また、測定開始信号ＭＳＴが入力してから測定信号ＭＣを出力する代りに、常に測定信号ＭＣを出力してフォトダイオードの電荷量をクリアしていれば、実際上は測定開始直前には既に光が遮断されている場合が多いから、測定開始信号ＭＳＴ入力後のクリアサイクルを省略し、直ちに主副の測定サイクルに入ってもよい。この場合には例えば測定信号ＭＣ１で副測定サイクルを、測定信号ＭＣ２で測定サイクルを実行し、測定信号ＭＣ１から（ｎ＋α）クロック後に発光信号ＦＳを出力すればよい。

【００４２】この実施例は、測定部１２に電荷量をシリアルに取出すマルチプレクサ１６を設けたが、受光部１１のフォトダイオードアレー６に、シフトレジスタを内蔵してシリアルに出力するフォトダイオードアレーを用いて、測定部１２のマルチプレクサ１６を省略してもよく、ＣＣＤのようなリニアセンサを用いても良い。

【００４３】図２に示したような分光透過率計では、各フォトダイオードが分担する分光域（帯域幅）が狭くなりｎが大きくなる程、入射光量が低下するのに反して周期Ｔが延びることによるノイズ分が増加する傾向があるから、この発明によりノイズ分のない測定光量データが得られる効果は大きい。

【００４４】以上説明した実施例はフォトダイオードアレー６を使用した場合であったが、モノクロームや視感度と一致する特性を有するセンサを用いてモノクロームに換算したデータを得る反射率計や濃度計、或いは分光特性を問題とする場合でもバンドパスフィルタやＲＧＢフィルタを交換してその都度測定するような、１個のセンサを用いた装置においても（例えばマルチプレクサ１６は不要になるが）、この発明を適用出来ることはいうまでもない。

【００４５】

【発明の効果】以上説明したように、この発明によれば迷光や暗電流等の影響を除いて正確な光量を測定することが出来る。

【図面の簡単な説明】

【図１】この発明の一実施例の電気系の構成を示す回路図である。

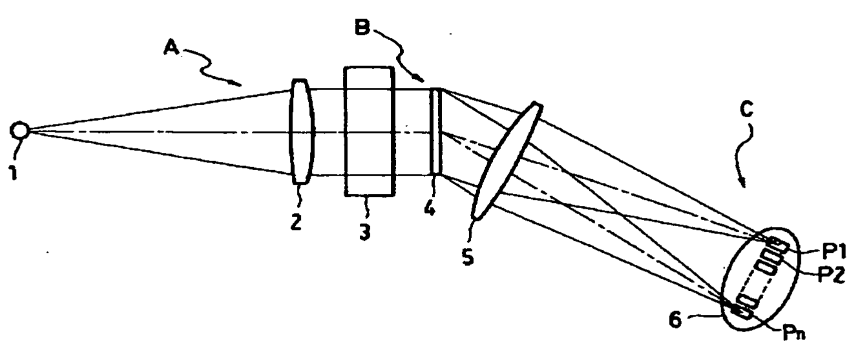
【図２】この発明の一実施例である分光透過率計の光学系の一例を示す概略構成図である。

【図３】図１に示した回路の各部信号の一例を示す波形図である。

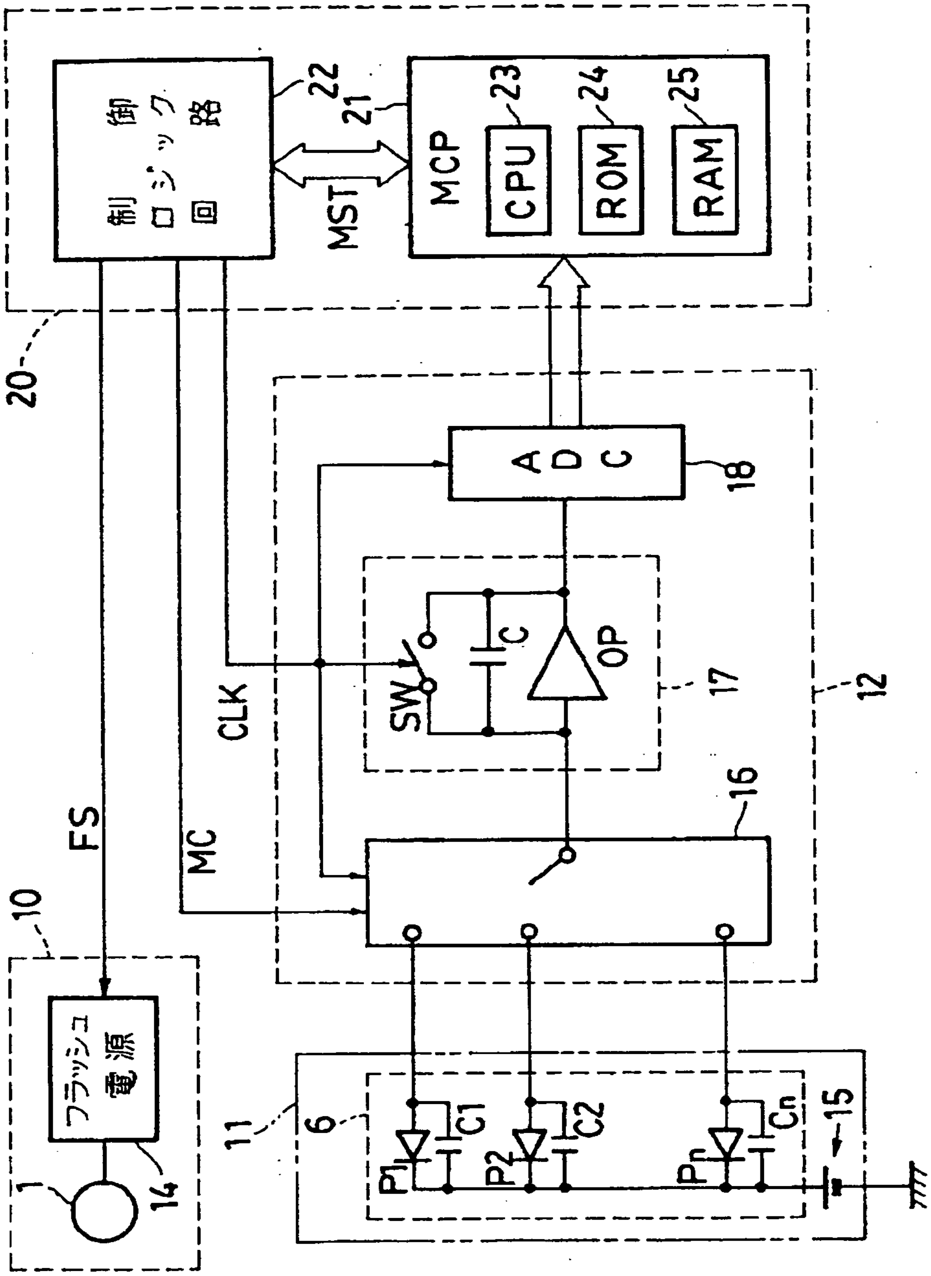
【符号の説明】

１　フラッシュ光源
３　試料
６　フォトダイオードアレー（光電変換素子群）
１２　測定部（測定手段）
１４　フラッシュ電源
２２　制御ロジック回路（タイミング手段）
２３　ＣＰＵ（演算手段）
２５　ＲＡＭ（データ記憶手段）
Ｐ１，Ｐ２…Ｐｎ　フォトダイオード（光電変換素子）
ＦＳ　発光信号
ＭＣ　測定信号
ＭＳＴ　測定開始信号

【図２】



【図１】


制御ロジック回路
22
21
MCP
23
CPU
24
ROM
25
RAM
MST
20
ADC
18
SW
C
OP
17
12
CLK
16
FS
MC
10
フラッシュ電源
14
1
11
6
P1
C1
P2
C2
Pn
Cn
15

【図3】